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10/577,630	04/28/2006	Rongzhen Yang	42P22089	9645

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EXAMINER
PATEL, HETUL B

ART UNIT	PAPER NUMBER
2186	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
	10/577,630	YANG, RONGZHEN
Office Action Summary	Examiner	Art Unit	
	HETUL PATEL	2186	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>03</u> MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>02 January 2009</u>.

2a) ☐ This action is **FINAL.**   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
    closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1 and 3-23</u> is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1 and 3-23</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a) ☐ All   b) ☐ Some * c) ☐ None of:

         1. ☐ Certified copies of the priority documents have been received.

         2. ☐ Certified copies of the priority documents have been received in Application No. _____.

         3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage
            application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>01/02/2009,03/02/2009</u>.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1.   This office action is in response to the claim amendment and remarks filed on
January 02, 2009. Claims 1, 3, 9-10, 12, 17-19 and 22 are amended; claim 2 is
cancelled; and none of the claims are newly added. Therefore, claims 1 and 3-23 are
currently pending in this application.

2.   All previously outstanding objections and/or rejections to the Applicant's
disclosure and/or claims not contained in this office action have been respectfully
withdrawn by the Examiner hereto.

3.   Applicant's arguments with respect to amended claim 1 have been considered
but are moot in view of the new ground(s) of rejection.

Specification

4.   The specification has not been checked to the extent necessary to determine the
presence of all possible minor errors. Applicant's cooperation is requested in correcting
any errors of which applicant may become aware in the specification.

Information Disclosure Statement

5.   The information disclosure statements (IDS) submitted on 01/02/2009 and
03/02/2009 are in compliance with the provisions of 37 CFR 1.97. Accordingly, the
information disclosure statements have been considered by the examiner.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6.   Claims 1, 3, 8-12, 17-19 and 21-22 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Mallick (USPN: 5,953,520) in view of Okada (USPN: 6,275,917).

As per claim 1, Mallick teaches a method, comprising: receiving a virtual page

number lookup request at a virtual Translation Lookaside Buffer (TLB) (i.e. receiving

logical (effective) address at the MMUs 56 and 58 in Fig. 2), wherein the virtual TLB (i.e.

the combination of ITLB and DTLB, 59 and 57 in Fig. 2) includes an instruction TLB (59

in Fig. 2) and a data TLB (57 in Fig. 2); performing a lookup of the virtual page number

in the virtual TLB; and returning a physical page number corresponding to the virtual

page number in the virtual TLB (i.e. if miss occurs, then an exception is taken and the

page table is searched for the matching PTE; see Col. 12, line 21 - Col. 13, line 7 and

Fig. 2).

However, Mallick does not teach that the lookup of the virtual page number in the

instruction TLB and the data TLB is performed simultaneously. Okada, on the other

hand, discloses about performing the address translation (i.e. searching in TLB) in both

ITLB and DTLB in parallel (see Col. 4, lines 50-55 and Col. 8, lines 21-24). Accordingly,

it would have been obvious to one of ordinary skills in the art at the time of the current

invention was made to implement the teaching of Okada in the method taught by Mallick

so the lookup is performed in parallel instead of one-by-one so the overall translation
process is expedited, especially when there is no match found in the first TLB.

As per claims 9-11, 17 and 21, refer rejection of claim 1. Claims 9-11, 17 and 21
are also rejected based on the same rationale as the rejection of claim 1.

As per claims 3, 12, 18-19 and 22, the combination of Mallick and Okada teaches
the claimed invention as described above and furthermore, Mallick teaches about
performing a page table lookup if the virtual address is not found in the virtual TLB (i.e. if
miss occurs, then an exception is taken and the page table is searched for the matching
PTE; see Col. 13, lines 2-7).

As per claim 8, the combination of Mallick and Okada teaches the claimed
invention as described above and furthermore, Mallick teaches that the virtual page
number lookup request is received from one of a Data Memory Management Unit
(DMMU) or an Instruction Memory Management Unit (IMMU) (see Col. 12, lines 37-40).

7.   Claims 4-7, 13-16, 20 and 23 are rejected under 35 U.S.C. 103(a) as being
unpatentable over Mallick in view of Okada, further in view of Augsburg et al. (USPN:
2007/0094476) hereinafter, Augsburg.

As per claims 4 and 5, the combination of Mallick and Okada teaches the
claimed invention as described above. However, both Mallick and Okada failed to
disclose about updating the virtual TLB with the virtual page number and a
corresponding physical page number resulting from the page table lookup, wherein
updating the virtual TLB includes: updating the data TLB if a physical address

corresponding to the virtual address has stored data; and updating the instruction TLB if

the physical address corresponding to the virtual address has stored an instruction.

Augsburg, on the other hand, teaches about having multiple TLBs and also separate

ITLB and DTLB; and when the desired virtual address generates TLB miss, both upper

and lower TLBs are updated with the new address information retrieved from the page

table (see paragraph [0004] and the abstract).   Accordingly, it would have been obvious

to one of ordinary skills in the art at the time of the current invention was made to

implement the teachings of Augsburg in the method taught by the combination of

Mallick and Okada so the future virtual TLB miss for the same virtual address is

avoided.

As per claims 13-14, 20 and 23, refer rejection of claims 4 and 5. Claims 13-14,

20 and 23 are also rejected based on the same rationale as the rejection of claims 4

and 5.

As per claims 6 and 15, the combination of Mallick, Okada and Augsburg

teaches the claimed invention as described above, but failed to specifically disclose

about using a round robin algorithm to update the virtual TLB. Updating TLB using

different algorithms such as LRU, MRU, FIFO, round-robin etc. Further, neither

Applicant nor the specification disclose that using a round robin algorithm to update the

virtual TLB as claimed here is critical, i.e. neither Applicant nor the specification disclose

that by updating the virtual TLB differently would downgrade the functionality or

performance of the cache memory of the claimed method and apparatus. Therefore,

updating the virtual TLB as claimed is considered to be an obvious matter of design

choice.

As per claims 7 and 16, the combination of Mallick, Okada and Augsburg

teaches the claimed invention as described above and furthermore, Augsburg teaches

that the page table lookup is performed by an operating system (see paragraphs [0002]

and [0023]).

Remarks

8.   As to the remark, Applicant asserted that

(a) In response to 101 rejection, Applicant has amended the specification and

requests Examiner to remove the 101 rejection of claims 21-23.

(b) Applicant respectfully submits that it does not necessarily flow from Mallick

that performing a lookup of a virtual page number in the DTLB 57 and ITLB

59 is done simultaneously. Col. 13, lines 2-5 of Mallick, which discloses "If the

required page table entry (PTE) is present in the **relevant** one of DTLB 57

and ITLB 59, the physical address corresponding to the logical address is

immediately available" (emphasis added), makes it clear that only the

appropriate TLB is accessed. Thus it does not necessarily follow that Mallick

performs the lookup of the virtual page number in the instruction TLB and the

data TLB simultaneously.

Examiner respectfully traverses Applicant's remark for the following reasons:

In response to (a), the 101 rejection for claims 21-23 has been withdrawn because applicant's deletion of such embodiments from the specification is being treated as an explicit act to remove such embodiments from the scope of the claims.

In response to (b), Examiner would like to point out to Applicant that this argument is mooted in view of new ground of rejection presented above.

Conclusion

9.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to HETUL PATEL whose telephone number is (571)272-4184. The examiner can normally be reached on 8:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Kim can be reached on 571-272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Hetul Patel/
Patent Examiner
Art Unit 2186